Technical Information Manual

Revision n.10
3 September 2013

MOD. A 1733 - A 1833
A 1733B - A 1833B
12/28 CHANNEL
HV BOARDS
MANUAL REV.10

NPO:
00101/00:17XXx.MUTx/10

CAEN will repair or replace any product within the guarantee period if the Guarantor declares that the product is defective due to workmanship or materials and has not been caused by mishandling, negligence on behalf of the User, accident or any abnormal conditions or operations.

CAEN declines all responsibility for damages or injuries caused by an improper use of the Modules due to negligence on behalf of the User. It is strongly recommended to read thoroughly the CAEN User's Manual before any kind of operation.

CE

CAEN reserves the right to change partially or entirely the contents of this Manual at any time and without giving any notice.

Disposal of the Product

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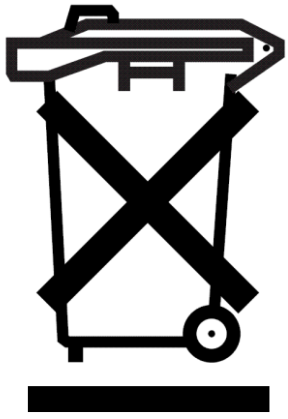

Made In Italy : We stress the fact that all the boards are made in Italy because in this globalized world, where getting the lowest possible price for products sometimes translates into poor pay and working conditions for the people who make them, at least you know that who made your board was reasonably paid and worked in a safe environment. (this obviously applies only to the boards marked "Made in Italy", we cannot attest to the manufacturing process of "third party" boards).

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1. Mod. A1733, A1833, A1733B, A1833B HV Boards

1.1 Functional description

The Mod. A 1733 – A 1833 are single width boards housing 12 HV channels with either positive (A 1733P – A 1833P) or negative (A 1733N – A 1833N) polarity.
28 channel double width versions (Mod. A 1733B – A 1833B) have either positive (A 1733BP – A 1833BP) or negative polarity (A 1733BN – A 1833BN)[1].
The Mod. A 1733 / A 1733B output channels have 3 kV / 3 mA or 4 kV / 2 mA full scale range (dip-switch selectable); the Mod. A 1833 / A 1833B output channels offer 3 kV / 3 mA or 4 kV / 2 mA or 4 kV / 200 µA full scale range (dip-switch selectable).
A 2 channel negative version of the A1833 (A1833DN) is also available. All boards are compatible with the CAEN Universal Multichannel Power Supply System (SYx527).
If the output voltage differs from the programmed value by more than 3% of voltage full scale range, the channel is signalled to be either in OVERVOLTAGE or UNDERVOLTAGE condition. Moreover, for each channel, a voltage protection limit SVMAX can be fixed via software with 1 V resolution and the output voltage can not be programmed beyond this value.
The HV RAMP-UP and RAMP-DOWN rates may be selected independently for each channel in the range 1÷ 500 V/s in 1 V/s steps.
The output current is monitored with 20 nA / 200 nA resolution depending on current range; if a channel tries to draw a current larger than its programmed limit it is signalled to be in OVERCURRENT condition; the SYx527system detects this state as a fault and reacts according to the setting of the TRIP parameter[2], namely:

1) TRIP=infinite (= 1000 s)

When the set output current value is reached the channel behaves like a constant current generator.

2) TRIP=finite (< 1000 s)

The output current keeps the set value only for programmed time interval and then is switched off.

The TRIP time (i.e. the maximum time an OVERCURRENT condition is allowed to last) can be programmed in 0.1 s steps.
The maximum output voltage (VMAX Hardware) can be fixed, through a potentiometer located on the front panel, at the same common value for all the board channels and this value can be read out via software.
The boards host also a temperature sensor located on the PCB near the HV channels: the temperature values measured by this sensor are used to signal Over Temperature condition on the SYx527.
The boards are provided with an "HV EN" input that disables the channels when it is not connected to ground.

[1] A 1733B – A 1833B are currently out of stock and no longer produced

[2] Refer to the SYx527 User's Manuals for details about the TRIP Handling.

1.2 Channel Characteristics Table

Table 1.1 – Channel characteristics of the Mod. A 1733 / 1733B - A 1833 / 1833B HV Boards

Polarity:	Positive / Negative depending on purchased version
Output Voltage:	dual range 0÷3 kV / 0÷4 kV
Max. Output Current:	low range 200 μA (Mod. A 1833 - A 1833B) high range 2/3 mA
Voltage Set/Monitor Resolution:	250 mV
Current Set/Monitor Resolution:	200 nA (Mod. A 1733 - A 1733B) 20 nA / 200 nA depending on current range (Mod. A 1833 – A 1833B)
VMAX hardware:	0÷4 kV common for all the board channels
VMAX hardware accuracy:	± 2% of FSR
VMAX software:	0÷4 kV settable for each channel
VMAX software resolution:	1 V
Ramp Down:	1÷500 Volt/sec, 1 Volt/sec step
Ramp Up:	1÷500 Volt/sec, 1 Volt/sec step
Voltage Ripple: [3]	< 30 mV pp (Mod. A 1833 – A 1733) < 50 mV pp (Mod. A 1833B – A 1733B)
Voltage Monitor vs. Output Voltage Accuracy: [4]	± 0.5 V ± 0.3% of reading
Voltage Set vs. Voltage Monitor Accuracy: [3]	± 0.25 V ± 0.3% of setting
Current Monitor vs. Output Current Accuracy: [3]	± 1 μA ± 2% of reading (2/3 mA range) ± 0.1 μA ± 2% of reading (200 μA range, Mod. A 1833 – A 1833B)
Current Set vs. Current Monitor Accuracy: [3]	± 0.2 μA ± 2% of setting (2/3 mA range) ± 0.02 μA ± 2% of setting (200 μA range, Mod. A 1833 – A 1833B)

[3] From 10 Hz to 15 MHz at full load

[4] From 10% to 90% of Full Scale Range

1.3 Front Panel

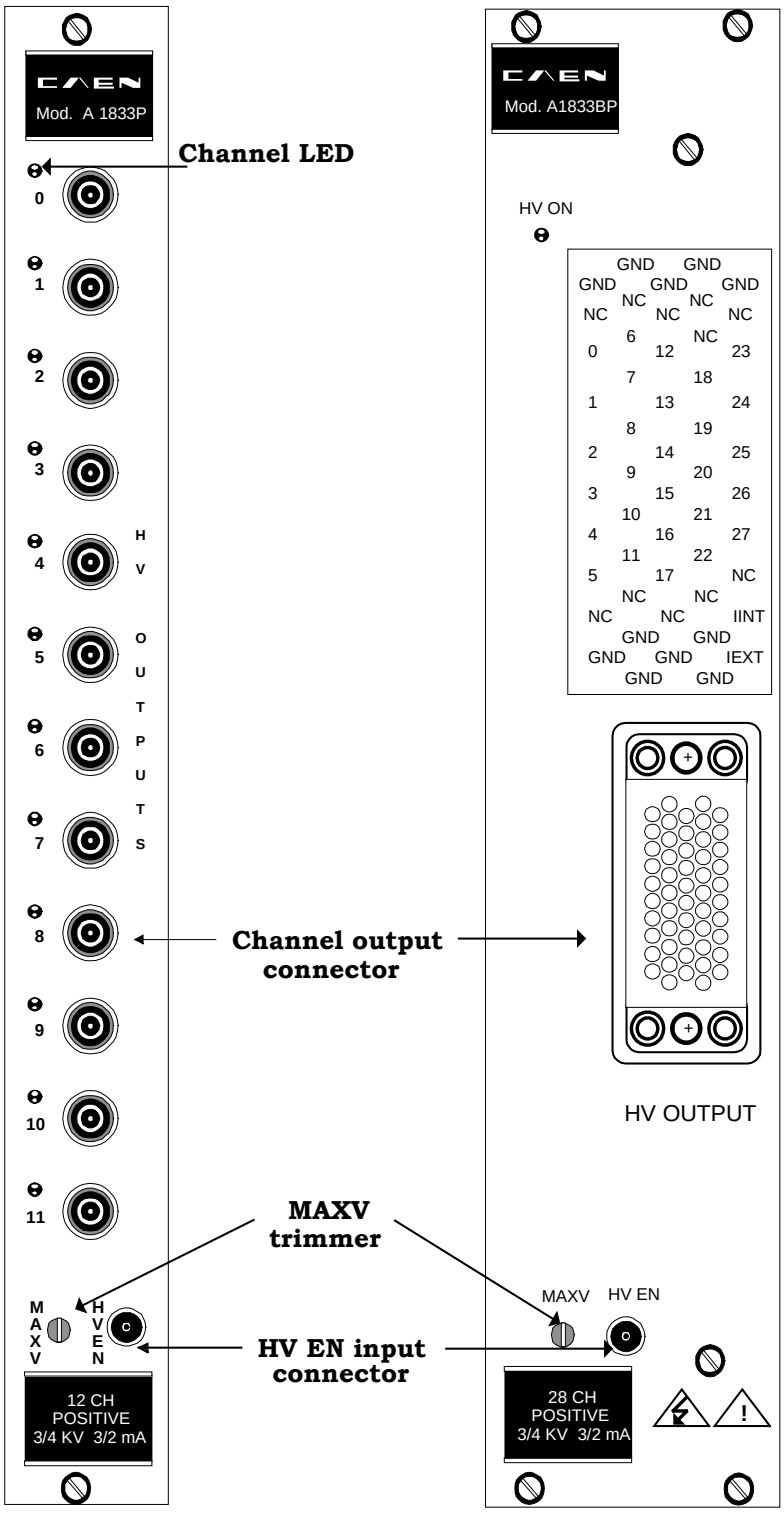

Fig. 1.1 – Mod. A 1733 – A 1833 (LEFT) and Mod. A 1733B – A 1833B (RIGHT) front panel

1.4 Technical Specifications

1.4.1 Packaging

The Mod. A 1733 – A 1833 modules are housed in a 5 TE-wide, 6U-high mechanics. The Mod. A 1733B – A 1833B modules are housed in a 10 TE-wide, 6U-high mechanics.

1.4.2 External connections

The location of all components of the front panel is shown in Fig. 1.1, p. 8. The function and electro-mechanical specifications of the external connectors are listed in the following subsections.

CH 0..11 (A 1733 – A 1833):

Mechanical specifications:
HV coaxial connectors
Radiall SHVR317580-type
Electrical specifications: high voltage output according to specifications given in Table 1.1, p.5.

CH 0..27 (A 1733B – A 1833B):

Mechanical specifications:
Multipin connector Radiall 691803004-type, 52 pin male (to be mated with Radiall 691802002-type[5] [*SCEM 09.41.34.700.2*]); see Fig. 2.2 for pin assignment.
Electrical specifications: high voltage output according to specifications given in Table 1.1, p.5.

HV EN CONNECTOR

Mechanical specifications**:**
00-type LEMO connector.
Electrical specifications: board ENABLE input, if connected to ground, the channels are enabled. Refer to § 3.2, p.12 for further details.

[5] Requires 52 pins Radiall 691804300 [*SCEM 09.41.33.830.7*] type, to be installed using the insertion/extraction tool Radiall 282549024 [*SCEM 34.95.17.125.3*] type.

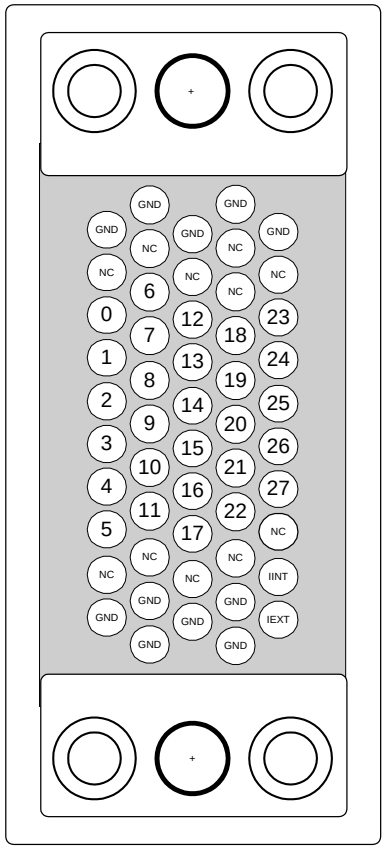

Fig. 1.2 – Mod. A 1733B – A 1833B HV Multipin Connector

1.4.3 Displays

CH ON 0..11 LEDs (A 1733 - A1833):

Function: they light up as the relevant channel is on.

Type: red LEDs for positive polarity version; yellow LEDs for negative polarity version

HV ON LED (A 1733B - A1833B):

Function: it lights up if at least one output channel is on.

Type: red LED for positive polarity version; yellow LED for negative polarity version

1.4.4 Other components

VMAX trimmer:

Function: it allows to adjust the hardware maximum voltage VMAX common to all the channels. Its value can be read out via software.

2. Safety information and installation requirements

2.1 General safety information

This section contains the fundamental safety rules for the installation and operation of the boards. Read thoroughly this section before starting any procedure of installation or operation of the product.

2.1.1 Injury Precautions

Review the following precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use the product only as specified. Only qualified personnel should perform service procedures.

Avoid Electric Overload.
To avoid electric shock or fire hazard, do not apply a voltage to a load that is outside the range specified for that load.

Avoid Electric Shock.
To avoid injury or loss of life, do not connect or disconnect cables while they are connected to a voltage source.

Do Not Operate Without Covers.
To avoid electric shock or fire hazard, do not operate this product with covers or panels removed.

Do Not Operate in Wet/Damp Conditions.
To avoid electric shock, do not operate this product in wet or damp conditions.

Do Not Operate in an Explosive Atmosphere.
To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.

Do Not Operate With Suspected Failures.
If you suspect there is damage to this product, have it inspected by qualified service personnel.

2.2 Safety Terms and Symbols on the Product

These terms may appear on the product:

- **DANGER** indicates an injury hazard immediately accessible as you read the marking.
- **WARNING** indicates an injury hazard not immediately accessible as you read the marking.
- **CAUTION** indicates a hazard to property including the product.

The following symbols may appear on the product:

DANGER

High Voltage

ATTENTION

Refer to Manual

2.3 Installation

The Mod. A 1733 – A 1833 are single-width boards which can be inserted in any slot of the SYx527 crate. The Mod. A 1733B – A 1833B are double-width boards which occupy two SYx527 slots each. At power ON the SYx527 system processor will scan all the slots in the crate to find out where the module is plugged and what kind of module it is.

3. Operating modes

The Mod. A 1733 – A 1833 and A 1733B – A 1833B boards can be controlled, either locally or remotely, through the SYx527 software interface. For details on SYx527 system operation, please refer to the User's Manual of this product. The following sections contain a description of commands available for the board control and status monitoring.

ATTENTION

THE MOD. A1733, A1833, A1733B, A1833B BOARDS REQUIRE SYx527 FIRMWARE VERSION 1.09.04 OR LATER

3.1 Output control and monitoring

For each output channel, it is possible, through the SYx527 system, to perform the following operations:

- Assign to channel a symbolic name
- Set output voltage (VSET)
- Set max. output current (ISET)
- Set output voltage software limit (SVMAX)
- Set voltage ramp-up speed (RAMP-UP)
- Set voltage ramp-down speed (RAMP-DOWN)
- Set TRIP parameter
- Enable/disable POWER ON option
- Switch channel ON/OFF
- Monitor output voltage (VMON)
- Monitor output current (IMON)
- Monitor channel status

If the POWER ON option is enabled, the channel, at POWER ON, is restored in the same condition it was before the POWER OFF or RESET; if this option is disabled, at POWER ON or after a RESET, the channel is kept OFF independently from its previous condition.

The following messages may be returned by the SYx527 when monitoring the channel status:

- OFF (channel turned OFF)
- RUP (channel ramping up)
- RDWN (channel ramping down)
- OVC (channel in OVERCURRENT condition)
- OVV (channel in OVERVOLTAGE condition)

- UNV (channel in UNDERVOLTAGE condition)
- EXTTRIP (channel OFF due to external TRIP line signal)
- INTTRIP (channel OFF due to internal OVERCURRENT condition)
- EXT_DIS (channel disabled by board INTERLOCK protection)

Moreover it is possible to monitor board temperature and to check board status; the following messages may be returned by the SYx527 when monitoring the board status:

- UNDER_TEMP (board temperature < 5°C)
- OVER_TEMP (board temperature > 65°C)

3.2 Output Enable

The following procedures must be performed in order to enable the board's operation:

- **All versions**: provide the "HV EN" connector with a 50 Ohm termination.

- **Mod. A 1733B – A 1833B**: provide short circuit between Pin 51 and Pin 52 (IINT and IEXT) of the HV Multipin Connector (see Fig. 2.2); this is a safety feature to verify that the connector is plugged and the channels are connected to their loads (see § 1.4.2). This operation is not necessary if the S1 pins on the PCB are short circuited.

Such procedures are unnecessary if the S2 pins on the PCB are short circuited.

S1 and S2 are placed on the PCB's lower edge, just behind the front panel.

When the channels are disabled the voltage outputs drop to zero at the maximum rate available; when the output disable cause is removed, the channels remain OFF until the User turns them ON via software.

3.3 Full scale range setting

The output voltage and current full scale range, common to all channels, can be selected by dip-switches (please refer to the Fig. 3.1 for the dip-switches location on the board).

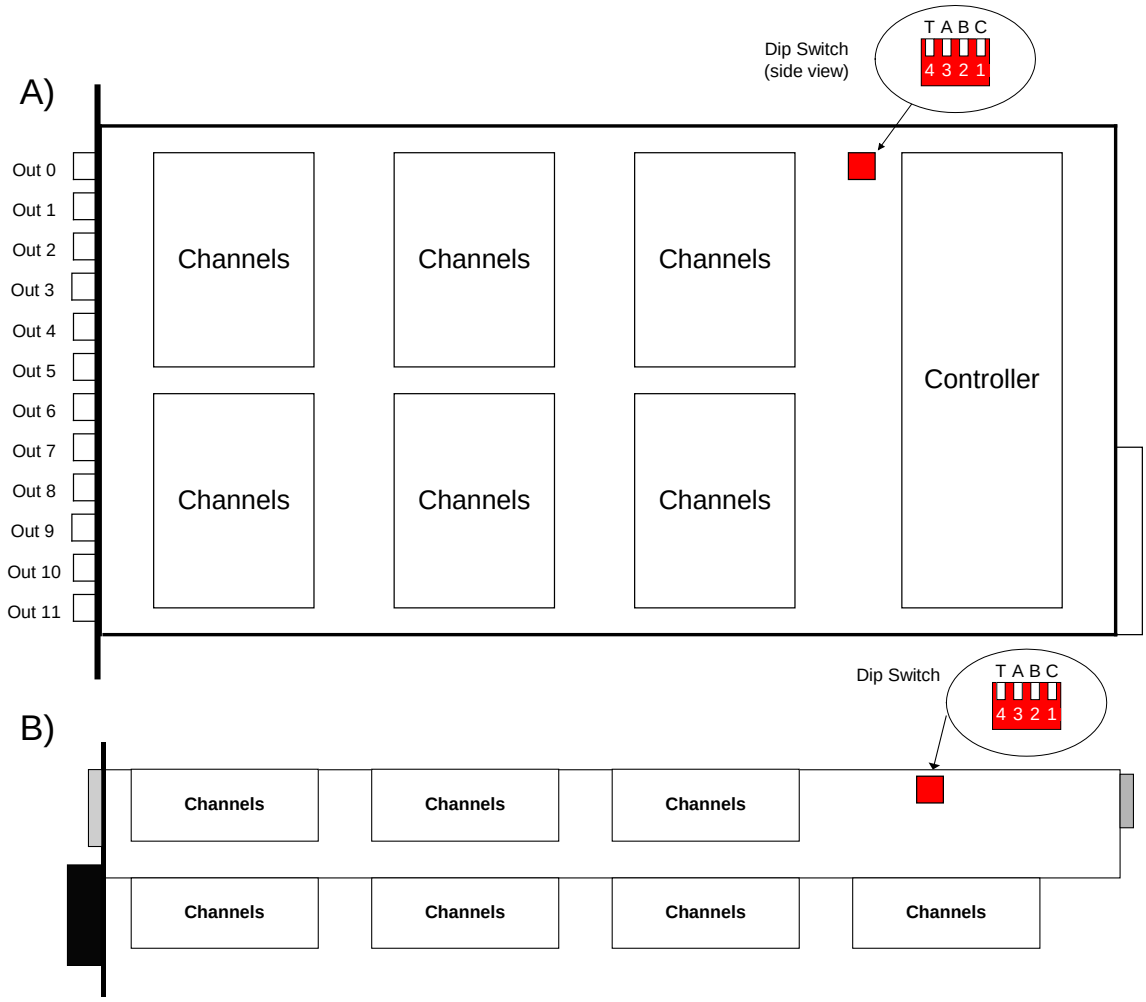

Fig. 3.1 – A) Mod. A1733 - A 1833 side view; B) Mod. A1733B - A 1833B top view

In order to select the desired Full Scale Range (FSR) the dip-switches must be set as illustrated in the following table.

Dip-switch 1	Dip-switch 2	Voltage FSR	Current FSR
ON	ON	3 kV	3 mA
OFF	ON	4 kV	2 mA
OFF	OFF	4 kV	200 μA

Table 3.1 – Full scale range settings

Full scale range selection must be performed before inserting the board into the crate.